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09/608,158	06/30/2000	Artur E. Balasinski	10200/82	1108

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EXAMINER

THANGAVELU, KANDASAMY

ART UNIT	PAPER NUMBER
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2123

DATE MAILED: 09/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/608,158

Applicant(s)

BALASINSKI ET AL.

Examiner

Kandasamy Thangavelu

Art Unit

2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 30 June 2000.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 June 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 9.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Introduction*

1. Claims 1-8 of the application have been examined.

### *Information Disclosure Statement*

2. Acknowledgment is made of the information disclosure statements filed on March 4, 2003 together with copies of the patents. The patents have been considered in reviewing the claims.

### *Drawings*

3. The draft person has objected to the drawings; see a copy of Form PTO-948 for an explanation.

### *Title*

4. The title says "Scheme for improving the predictability and/or reliability of photolithographic images". However, neither the specification describes the scheme for improving the ***predictability and/or reliability*** of photolithographic images nor the application claims any method or system for improving the ***predictability and/or reliability*** of photolithographic images. So a change of title of the application to reflect

Art Unit: 2123

the material described in the specification and claimed is recommended.. A scheme for improving the accuracy of integrated circuit pattern simulation may be appropriate.

### ***Specification***

5. The disclosure is objected to because of the following informalities:

Page 8, Line 24, "Such corrections/optimized" appears to be incorrect and it appears it should be deleted.

Page 13, Line 2, "compared to the overlay of the SEM reticel to the drawn layout" appears to be incorrect and it appears it should be "compared to the overlay of the SEM reticle to the drawn layout".

Appropriate corrections are required.

### ***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

Art Unit: 2123

7. Claims 1-4 and 6-8 are rejected under 35 U.S.C. 102(e) as being anticipated by **Chang et al. (CH)** (U.S. Patent 6,470,489).

7.1 **HE** teaches Design rule checking system and method. Specifically, as per Claim 1, **CH** teaches a method comprising simulating a photolithographic mask for fabrication of an integrated circuit (CL4, L38-47, CL5, L8-10); then simulating an image to be produced by that mask on a wafer (Abstract, L2-7, CL4, L5-9).

Dependent claims

Per Claim 2: **CH** teaches the method of claim 1 further comprising correcting and/or optimizing the mask and/or the simulation or image thereof (CL3, L41-43; CL4, L36-46).

Per Claim 3: **CH** teaches that the correcting and/or optimizing comprises increasing or decreasing at least one magnitude or value of (a) an optical proximity correction factor and/or (b) a serif (CL3, L37-43; CL14, L41-43).

7.2 As per Claim 4, **CH** teaches a method comprising simulating optical proximity effects of a mask for fabrication of an integrated circuit (Fig. 12; CL17, L37-41); and correcting corner rounding effects in an image produced by the mask (Fig. 7; CL14, L31-58).

7.3 As per Claim 6, **CH** teaches a method comprising incorporating corrections for corner rounding effects in an image produced by an integrated circuit mask into an optical proximity correcting procedure by adjusting an as-drawn layout of the mask as part of a computer aided design process (Fig. 7; CL14, L31-58).

Dependent claims

Per Claim 7: **CH** teaches that distortions are applied to corners and serifs in the mask (CL14, L31-58).

7.4 As per Claim 8, **CH** teaches a format for data input into or output from either or both simulating steps of claim 1, each format being compatible with the other (CL5, L21-22; CL15, L10-11; CL4, L57-60).

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

9. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Art Unit: 2123

10. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Chang et al. (CH)** (U.S. Patent 6,470,489) in view of **Pati (PA)** ("Panel: Subwavelength lithography: How will it affect your design flow?", IEEE, 1999).

10.1 As per claim 5, **CH** teaches the method of Claim 4. **CH** does not expressly teach that the optical proximity effects comprise effects of light having a wavelength of approximately four times a feature size of the image. **PA** teaches that the optical proximity effects comprise effects of light having a wavelength of approximately four times a feature size of the image (CL1, Para 2), as these techniques offer potential for substantial speed, power and area benefits and because they are implemented through software models, the cost and time to realize these benefits are substantially smaller than equipment upgrades (CL1, Para 2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **CH** with the method of **PA** that included the optical proximity effects comprising effects of light having a wavelength of approximately four times a feature size of the image, as these techniques offer potential for substantial speed, power and area benefits and because they would be implemented through software models, the cost and time to realize these benefits would be substantially smaller than equipment upgrades.

### ***Conclusion***

11. The prior art made of record and not relied upon is considered pertinent to the Applicants' disclosure.

The following patents and papers are cited to further show the state of the art at the time of Applicants' invention with respect to improving the accuracy of simulating a photolithographic mask.

1. Chang et al., "Method and apparatus for data hierarchy maintenance in a system for mask description", U.S. Patent 6,453,452, September 2002.
2. Pierrat, "Method for optimizing printing of a phase shift mask having a phase shift error", U.S. Patent 6,096,457, August 2000.
3. Kahng et al., "Subwavelength lithography and its potential impact on design and EDA", ACM, June 25, 1999.
4. Pasch et al., "System and method for performing optical proximity correction ...", U.S. Patent 6,425,117, July 2002.
5. Bula et al., "Method of modifying a microchip layout data set to generate a predicted mask printed data set", U.S. Patent 6,261,724, July 2001.
6. Wong et al., "Kernel based fast aerial image computation for a large scale design of integrated circuit patterns", U.S. Patent 6,223,139, April 2001.
7. Aleshin et al., "Geometric aerial image simulation", U.S. Patent 6,263,299, July 2001.
8. Kamon, "Method for forming a pattern using proximity effect correction", U.S. Patent 6,453,274, September 2002.
9. Cobb, "Streamlined IC mask layout optical and process correction through correction reuse", U.S. Patent 6,301,697, October 2001.

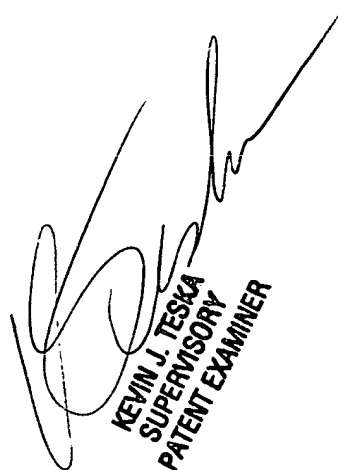


10. Bula et al., "Process for enhanced lithographic imaging", U.S. Patent 6,383,719, May 2002.
11. Sogard, "Tunneling device", U.S. Patent 5,866,935, February 1999.
12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Kandasamy Thangavelu whose telephone number is 703-305-0043. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:30 PM.

If attempts to reach examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Teska, can be reached on (703) 305-9704. The fax phone number for the organization where this application or proceeding is assigned is 703-746-7329.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-9600.

K. Thangavelu  
Art Unit 2123  
September 5, 2003



KEVIN J. TESKA  
SUPERVISORY  
PATENT EXAMINER